

by-side comparison.

Specifically, the Examiner requests that Applicants show examples of reactions using either triethylamine or lithium carbonate, which are the same bases shown in the two-base example. The Examiner also suggests that Applicants use only one alcohol in the examples.

Applicants' Arguments

The present invention is characterized in that a fluorine-containing acrylic acid ester represented by the general formula (IV) is produced by reacting 1-bromo-1-perfluoroalkylethene represented by the general formula (I) or 1,2-dibromo-1-perfluoroalkylethane represented by the general formula (II) with an alcohol represented by the general formula (III) in the presence of a palladium catalyst, carbon monoxide, and two or more kinds of bases.

In contrast to this, the Examiner states that *"Matteoli et al. teaches a process for producing a fluorine-containing acrylic acid ester (acrylic ester), in which 2-bromo-3,3,3-trifluoropropene is reacted with a straight aliphatic alcohol, among others, along with a palladium catalyst, carbon monoxide and two kinds of bases, diethylamine and triethylamine."*

Matteoli et al. certainly disclose the simultaneous use of diethylamine and triethylamine in the synthesis of N,N-disubstituted amides of fluorine-containing acrylic acids. In this case, however, diethylamine is not used as a base, but as a reaction material just like an alcohol.

Scheme 2 illustrated in the Matteoli et al. reference clearly shows that the reaction with alcohol can provide fluorine-containing acrylic acid esters, whereas the reaction with secondary amine can provide N,N-disubstituted amides of fluorine-containing acrylic acids. In view of this, one skilled in the art would expect that the simultaneous use of alcohol and secondary amine would provide a complex mixture of acrylic acid esters and acrylamides. Applicants have conducted experiments, which confirm the expected results. These experiments are set forth in the enclosed 1.132 Declaration, marked as Attachment A.

Accordingly, one skilled in the art cannot expect the ester production process of the present invention, based on the teachings of Matteoli et al.

Further, as discussed above, the Examiner states that *"the Applicant has not shown a true side by side comparison"*. In the previously submitted Declaration, [February 1, 2008], different

bases and alcohols were used in the comparative experiment and the experiment representing the present invention (in which the combination of two kinds of bases is used). Applicants have conducted other experiments in which 2-trifluoromethyl acrylic acid t-butyl ester was synthesized using triethylamine and t-BuONa as typical bases concurrently or singly, the results of which are presented as another 1.132 Declaration, enclosed herewith as Attachment B. When the bases are used in combination, the target product of fluorine-containing acrylic acid ester is obtained with a significantly higher yield, while the generation of alkoxy fluorine-containing propionic acid ester as a byproduct is suppressed, as compared with the case where each of the bases was used singly.

Additionally, Comparative Examples 1 to 23, disclosed in the original specification, provide results regarding experiments in which various alcohols were used as a reaction material and a base was used singly. These Comparative Examples correspond to the respective Examples set forth in the original specification. For example, Comparative Example 1 should be compared with Example 1. In Comparative Example 1, triethylamine was used singly as a base and the target compound of 2-trifluoromethyl acrylic acid ethyl ester was obtained with a yield of 64.6%, while 3-ethoxy-2-(trifluoromethyl)propionic acid ethyl ester was obtained with a yield of 13.2%. Comparative Example 1 should be compared to Example 1, which employed triethylamine and sodium hydride as bases, and the target compound of 2-trifluoromethyl acrylic acid ethyl ester was obtained with a higher yield of 74.9%, while the generation of by-product of 3-ethoxy-2-(trifluoromethyl)propionic acid ethyl ester was suppressed with a lesser yield of 5.1%. Based on the comparisons between the other Examples of the present invention and the corresponding Comparative Examples, when using two kinds of bases, it is clear that the target compound of fluorine-containing acrylic acid esters can be obtained with a significantly improved yield.

In the description of the present application, various examples of the alcohol are shown, including ethanol, 1-propanol, 1-butanol, 2-methyl-1-propanol, 1-pentanol, cyclohexylmethanol, benzylalcohol, 2-methoxyethanol, 2-propanol, 2-hexanol, cyclohexanol, cyclooctanol, 1-cyclohexylethanol, 1-menthol, t-butyl alcohol, 1-adamantanol, 2-methyl-2-adamantanol, 2-butyl-2-adamantanol, and 1,3-adamantanediol. Accordingly, it is clear that the improved yields of fluorine-containing acrylic acid esters, and the suppressed generation of by-products (fluorine-containing alkoxypropionic acid ester), are not based upon a particular alcohol, but instead result

from the production process with the co-presence of two or more kinds of bases. Furthermore, the improved yields of fluorine-containing acrylic acid esters and suppressed generation of by-products do not result from a particular base, because various bases such as triethylamine, sodium hydride, sodium carbonate, lithium carbonate, sodium t-butoxide, and the like were used.

The Examiner further states that *"The Examiner points to the yields in Fuchikami et al. which produce up to 93% yield, using triethylamine as the base (column 8, example 8, lines 4), in comparison to Applicant's examples with lower yields (see example 1, 79.4% yield, page 12, line 18)."* Applicants acknowledge that some Examples of the original specification showed lower yields than that shown in the Fuchikami reference. This is because the starting materials and target products of the present invention have highly reactive double bonds, whereas the target product of Fuchikami et al. is a saturated carboxylic acid. Namely, when the starting materials and target products each have a double bond, the reaction system may be complicated, and as a result, the selectivity of the required reaction may be reduced due to the by-product of fluorine-containing alkoxypropionic acid ester or other side reactions, resulting in lowered yield of fluorine-containing acrylic acid esters. One of the objects of the present invention is to suppress the side reactions for increasing the target product yield. This object is not related to the teachings of Fuchikami et al., because of the production (in the reference) of saturated carboxylic acids having no double bonds. Accordingly, Applicants' invention relates not only to the improvement in selectivity of carbonylation reaction, but also to the suppression of the undesired side reactions due to the presence of double bonds.

In view of these, any lower yields of the Examples in the original specification are due to more objects being achieved, as compared to the teachings of Fuchikami et al.

As discussed above, the present invention, namely the process for producing a fluorine-containing acrylic acid ester, is not taught or suggested by the cited combination of references. Applicants respectfully request that the Examiner re-examine the present application in view of the above remarks and the enclosed Declarations.

In view of the above remarks, it is clear that the subject matter of Applicants' claims is clearly patentable over the cited combination of references.

Conclusion

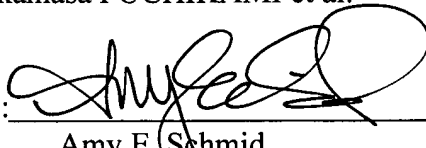
Therefore, in view of the foregoing remarks, it is submitted that the ground of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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Attachments A & B